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ON ANIMAL VACCINATION.¹

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THE term "Animal Vaccination" is applied to the process of propagating the virus of *spontaneous* cowpox through successive generations of healthy heifers, and to the subsequent vaccination of the human subject with this lymph. This method of obtaining vaccine lymph has been pursued in Naples during nearly sixty years. Instituted there by Dr. Traja, in 1810, animal vaccination was continued after his death by Drs. Galbiati and Negri; it was introduced into Paris about five years ago by Dr. Depaul; into Berlin by Dr. Pissin, in June, 1865; into St. Petersburg by Dr. Fröbelius, in 1867; and into Brussels by Dr. Warlomont, in 1865. This process has already received so favorable a reception from foreign governments, that in Italy, where vaccination is compulsory, while vaccinating from "*arm-to arm*" is the method ordinarily employed, two or more institutions have been established for the purpose of supplying heifer's lymph when desired. The French, Belgian, and Russian governments, have each sanctioned similar establishments in Paris, Brussels, and St. Petersburg, respectively; and branch institutions for the same purpose are being commenced in other cities of those countries. It is in consequence of dissatisfaction with ordinary, humanised vaccine lymph, that animal vaccination has thus been introduced into these parts of the Continent.

Mode of Operating on the Heifer, and its Effects.—The heifer to be employed should be a healthy animal, from six weeks to three months old. Before being operated on, it is tied down to a table by means of strong, padded leather straps, which, while restraining the movements of the animal, do not injure it in any way. One strap round the animal's neck fastens its head, while its fore limbs are fixed by means of a second strap, and a girdle keeps its body from moving. In St. Petersburg two assistants are employed for holding fast the animal's hinder limbs, and allowing its abdomen to be well

¹ The following remarks on "Animal Vaccination" are based both on a study of the literature of the subject, and on personal observation of the methods now actually pursued in Paris, Brussels, and St. Petersburg.

exposed. Dr. Blanc, who lately practised animal vaccination in London, made use of only one assistant, and fixed one hind limb to the operating table, while the other was secured by means of a rope to the ceiling of the room. The next procedure is to shave carefully the lower half of the heifer's abdomen. The animal is inoculated by making 120 to 200 punctures or incisions linearly, penetrating the cuticle only. On the Continent a lancet, with a triangular point containing a groove, is employed both for the vaccination of the heifer and of children. This lancet is charged with lymph, and is inserted by puncture just below the cuticle. This mode of vaccinating allows of greater rapidity than when scratches are made. After the heifer has been inoculated, a flannel bandage is fastened round the abdomen in order to prevent the animal from injuring the vesicles. The heifer is fed after the operation on the food to which it has been accustomed. If the animal suffer from diarrhœa, the addition of rice to its milk will generally restrain this disorder; but more commonly there is a tendency to constipation, which is corrected by the administration of meal. During the first two or three days after inoculation the vesicles are not observable; about the close of the third day, they can be felt to project slightly; on the fourth, they contain a minute quantity of lymph; and they become fully developed on the two succeeding days. Vesicles of the fourth day after inoculation are employed by the vaccinators in St. Petersburg for the inoculation of the next heifer; and vesicles of the fifth and sixth days, for the vaccination of children. In the Foundlings' Hospital of that city, 100 to 200 children are vaccinated daily from the heifer; and here the process of animal vaccination and its results can be studied most conveniently. At this establishment four heifers are kept always ready for the purpose of vaccinating children, and as many as twenty heifers per month are inoculated. The children are vaccinated by six punctures, generally three on each arm. Vaccination by "incision," by "scratches," or by "punctures," is equally successful, in the inoculation of the heifer and in the vaccination of children.

Advantages ascribed to "Animal Vaccination."—The lymph of spontaneous cow-pox, after having passed through the system of a heifer, or of a series of heifers, is held by some to excel ordinary "humanised" lymph, because of the more perfect characters presented by the vesicles thus produced, and which are, therefore, believed to afford a greater protection against smallpox; because of the impossibility of transmitting disease through this source; and because in this way a larger supply of vaccine lymph can be obtained, especially on an emergency, than by the "arm-to-arm" process.

The assertion that the lymph employed in animal vaccination produces better vesicles and a more perfect protection against smallpox

involves the supposition that the ordinary vaccine has undergone deterioration. Our first duty, therefore, is to define a *typical* vesicle of the eighth day, when it has attained its perfection, and then with this type to compare vesicles derived from the two sources in question. A typical vesicle "is plump, round, and more decidedly pearl-coloured; it is distended with clear lymph; the elevation of its margin and the depression of its centre are more marked. At this date, or sometimes a few hours earlier, a ring of inflammation, termed the areola, begins to form about its base. The areola is circular, and, when fully developed, has a diameter of from one to two inches; it is often attended with considerable hardness and swelling of the subjacent connective tissue."¹ Such, according to Dr. Seaton, are the characters for which a vaccinator is to look when judging of the results of his operation; and such are the appearances presented by vesicles developed by animal vaccination, except in one particular, viz. the extent and constitution of the areola. The "ring of inflammation" surrounding a vaccine vesicle appears to me to be the indication of an effort made by a healthy system to get rid of the results of a local irritant, and therefore ought not to be looked upon as "the anatomical evidence that the cow-pox has produced its specific effect on the constitution."² It is the secretion of the lymph which I regard as affording this anatomical evidence. The areola resulting from vaccination with heifer's lymph is, on the eighth day, less extensive, radiating from one quarter to three quarters of an inch around the vesicle, of a bright pink colour, and is *unaccompanied by hardness of the subjacent connective tissue*. The larger and the more indurated is the areola, the more irritative, but not necessarily the more effective, is the action of the vaccine lymph. On the other hand, after vaccinating with heifer's lymph, this inflammatory ring is, on the tenth or eleventh day, often of larger extent than when humanised lymph has been used, and may occupy one half of the circumference of the arm. It is accompanied by more or less induration, but this disappears generally about twenty-four hours after it has attained its maximum; whereas, after vaccination with ordinary lymph, the areola requires longer time for its complete disappearance. On examining carefully by the touch, arms which have been vaccinated by these two methods, and comparing them, I have always been struck with the more elastic feel of the areola on the arm of a child vaccinated with heifer's lymph than of the areola induced by humanised lymph; and this difference cannot be better expressed than by saying that the former variety of areola is like the base of a healthy acute abscess, while the latter resembles the base of a subacute or chronic abscess. Some experienced vaccinators regard a large areola on the *eighth* day after

¹ Seaton, Ed. C., 'A Handbook of Vaccination,' 1868, p. 68.

² Ibid.

vaccination as a favorable sign of a successful operation ; and were this the true view, ordinary lymph would have the advantage over heifer's lymph. But, accompanying such inflammatory action, the vesicle very frequently appears opaline, the lymph is of a yellow colour and very fluid, or looks muddy ; whereas, the vesicles induced by heifer's lymph are (on the eighth day) surrounded by scarcely any areola, are beautifully clear and transparent, and have a pearly lustre ; and the lymph procured from such vesicles is less in quantity, flows less readily, and is of a crystalline appearance. Further, vaccinia induced by heifer's lymph runs its course more slowly than does the disease generated by humanised lymph. On this account the former may be regarded as producing a more gradual effect on the constitution, and thereby affording a more permanent protection against smallpox.

Lastly, the appearance of the cicatrix distinguishes successful vaccination. A typical cicatrix is "circular, somewhat depressed, foveated or indented with minute pits, and sometimes radiated. A well foveated cicatrix is, next to having watched the vaccination through its course, the best test we have of the security of the system against smallpox".¹ The cicatrices following vaccination with heifer's lymph are usually of this class, the very kind to be desired. But on searching carefully for such cicatrices after vaccination with ordinary lymph, I have seen them only in a small per-centage of cases. Well-formed transparent vesicles, enclosing clear limpid lymph, surrounded by little inflammatory redness, and leaving characteristic cicatrices, are the results of vaccination with heifer's lymph. While such results, according to our observation, invariably follow animal vaccination, they are much more rarely met with after vaccination with humanised lymph.

In the next place it is necessary to adduce proof that vaccination with heifer's lymph affords a better protection against smallpox than does vaccination with humanised lymph. The evidence just cited favours this opinion. From the limited extent to which animal vaccination has been practised compared with vaccination with ordinary lymph it is impossible to collect statistics of the mortality from smallpox amongst those vaccinated according to these methods respectively. Nor do statistics showing the diminished mortality from smallpox after vaccination appear to me to guarantee the inference that vaccination with ordinary lymph is as protective as might be desired. If numbers could be produced to prove that smallpox *attacks* fewer persons after vaccination than after variolic inoculation, or that it is better warded off by vaccination with ordinary lymph than by animal vaccination, we would be placed in a position to draw a fair deduction. But, in examining the mortality after smallpox now-a-days, as compared with that twenty years ago, we have to make

¹ Seaton, *Ibid.*, p. 69.

allowance for the better knowledge of the treatment of fevers in the present day as compared with what it was then. It is undeniable, that many instances of smallpox are still met with, that epidemics of smallpox still break out, even in countries where vaccination has been legally enforced, and that smallpox attacks children only a few years after their protection by means of vaccination.

Additional proof of the greater influence of heifer's lymph over the human economy, as compared with ordinary lymph, is furnished by the results of revaccination with heifer lymph. Dr. Warlomont, of Brussels, gives the following results of revaccination with the two kinds of lymph. Among 924 individuals, between seven and twenty years old, bearing good evidence of a previously successful vaccination, revaccination with heifer lymph succeeded in 211 instances, *i. e.* in 22·83 per cent. ; while in the case of 277 individuals, from ten to twenty years old, likewise bearing good vaccinal cicatrices, revaccination with ordinary lymph succeeded 9 times, *i. e.* in 3·24 per cent. Again, 6749 Neapolitan soldiers were revaccinated with heifer's lymph, and among these 1670, or 24·74 per cent., had true vaccinia.¹ Still further evidence of the success of revaccination is afforded by a glance at the following table extracted from Dr. Seaton's 'Handbook of Vaccination':²

| Persons in whom the revaccinations were performed. | Degree of success of re-vaccinations. | In those who bore marks of previous smallpox. | In those who bore good marks of previous vaccination. | In those who bore doubtful or imperfect marks of previous vaccination. | In those who bore no marks of previous vaccination or smallpox. |
|---|---------------------------------------|---|---|--|---|
| | | Per 1000 | Per 1000 | Per 1000 | Per 1000 |
| Württemberg army, 1831-5 (13,861 cases). | Perfect | 319·5 | 310·4 | 280·7 | 337·3 |
| | Modified | 248·1 | 280·5 | 259·0 | 191·1 |
| | None | 432·3 | 409·2 | 460·4 | 471·6 |
| Soldiers in British army, not recruits, in 1861 (2053 cases). | Perfect | 451·4 | 484·6 | 236·8 | 326·0 |
| | Modified | 195·6 | 157·4 | 505·0 | 277·5 |
| | None | 389·0 | 358·0 | 257·9 | 396·5 |
| Recruits in British army in 1861 (4395 cases). | Perfect | 345·5 | 407·3 | 461·3 | 527·3 |
| | Modified | 266·8 | 240·8 | 301·3 | 202·6 |
| | None | 387·7 | 351·9 | 237·4 | 270·1 |

¹ Dr. Warlomont, 'De la Vaccination Animale et de l'utilité des Revaccinations à tous les âges de la vie.' Bruxelles, 1865.

Of his revaccinations with heifer's lymph he states that—

180 children were 9 to 12½ years old, and of these 63 showed beautiful vesicles.
 200 " " 7 " 9 " " 20 " " "
 40 " " 7 " 13 " " 8 " " "
 33 " " under 20 " " 13 " " "
 71 " " 14 to 20 " " 31 " " "
 In 406 cases the age is not stated, but among these 76 " " "

² Seaton, E. C., 'A Handbook of Vaccination,' 1868, p. 279.

I have revaccinated individuals, varying from eleven to twenty-four years of age, both directly from the heifer and from a child's arm. My opportunity for so doing has been very limited, but it has sufficed to convince me that heifer lymph is more efficacious than ordinary lymph when thus employed. From the preceding statistics we may, I think, draw two inferences, viz. that vaccination does not impart a permanent protection against smallpox, and hence that revaccination is advisable; and also that heifer's lymph, when employed for revaccination, is attended with greater success than follows revaccination with ordinary vaccine lymph. If, then, heifer's lymph is more efficacious than humanised lymph when used for revaccination, especially for the revaccination of individuals who have been vaccinated successfully with ordinary lymph only a few years previously, we may conclude that this tends to show the deterioration of ordinary lymph and the greater protective properties of heifer's lymph.

It is not supposed that the deterioration of vaccine lymph is due to the mere number of beings through whom the matter has been transmitted, provided the transmission has been effected in a proper manner; but to the careless performance of vaccination which has frequently occurred, either from not selecting good vesicles, or from taking the lymph at an improper time. If pure vaccine lymph, derived from spontaneous cowpox directly or indirectly through a heifer, is propagated carefully through a well-selected series of human beings, we may safely say that it does not lose any of its effective properties—does not degenerate in consequence of such transmission. Dr. Jenner believed that vaccine lymph could be made to pass through a lengthened succession of human beings without undergoing any alteration, and the experience of the last fifty years confirms this presumption. On the other hand, if vaccine lymph, a most delicate, organic fluid, has once been allowed to undergo pathological changes in the vesicles,—has been permitted, for example, to remain in the vesicle till the ninth day, or even later, after vaccination, when suppuration has commenced to alter its composition,—can it be supposed that it has undergone no deterioration? And if such lymph is used for vaccination, is it reasonable to conceive that the passage of this fluid through a child's constitution is sufficient to restore its purity, and to supply any protective power it may have lost? It is generally admitted that vaccination has been hitherto very carelessly performed in this country—that vaccine lymph has been removed from vesicles which were undergoing suppurative changes—that vaccination has been performed with lymph from imperfectly or improperly developed vesicles; and yet it is affirmed that if such lymph be carefully employed hereafter it will produce results identical with those of the true virus, will be equally protective with the original cowpox. According to this view, the system

of a healthy child is made to serve the part, not only of a searching filter, but of a reproducing spring. If vaccination has been performed in this country, so that one half of those vaccinated are not in reality benefited by the operation—that, in fact, 50 per cent. of those vaccinated present imperfect cicatrices,—it is presumable that the “ordinary lymph” (not only the lymph used in certain parts of the country, but indirectly all the vaccine lymph employed) has suffered from this inattention to the necessary conditions of safe vaccination. Instead, therefore, of insisting that, when this imperfect lymph is passed through the system of a healthy child, it becomes pure vaccine lymph—identical with the virus derived from the cow—it would surely be better, scientifically more consistent, to return to the original source of vaccinia, and in place of employing the virus of spontaneous cow-pox, which is found to act severely on the human system, to use heifer lymph, which “has all the qualities of that of the spontaneous disease, except its too frequent acrimony.” By renewing vaccine lymph in this way, we admit that the lymph at present employed is imperfect, not in consequence of a continuous transmission through successive human generations, but because its efficacy has been impaired by a careless propagation of it in the human subject.

Results obtained by Animal Vaccination.—The only experimental inquiry into animal vaccination as yet undertaken by any scientific body, was that carried out by a committee of nine medical men chosen by the Academy of Medicine in Paris, and at whose disposal 6000 francs were placed. This committee prosecuted their researches during 1866, and published their report in the following year. They state the objects aimed at by them in making this inquiry to be two-fold. “In the first place, the effects of the employment of lymph from two sources of spontaneous cow-pox were carefully tested by experiment, the preservation of genuine lymph by transmission from heifer to heifer was thoroughly investigated, and the impossibility of transmitting syphilis to the bovine species was proven. In the second place, experiments were made to show the comparative advantages of vaccination with heifer lymph over arm-to-arm vaccination.”¹ The lymph of spontaneous cow-pox was derived partly from M. Nègri’s establishment in Naples, partly from an instance of the natural disease which occurred in Beaugency. With these forms of lymph 41 experiments were made. In order to test the comparative merits of vaccination from the heifer and of arm-to-arm vaccination, 71 experiments were carried out: 681 children were vaccinated with heifer lymph, 897 children with humanised lymph. With the object of investigating the communicability by vaccination of syphilis to the

¹ ‘Expériences faites à l’Académie Impériale de Médecine avec le Cow-pox ou Vaccin. Animal.’ *Compte rendu adressé à son Exc. M. le Ministre de l’Agriculture, du Commerce, et des Travaux publics, par M. Depaul, 1867.*

bovine species only 3 experiments were made by the committee; but the report refers to other experiments, having a similar aim, made by private individuals.

Animal vaccination has been pursued on an extensive scale in various Continental cities by individuals; and the aggregate experience of these several vaccinators forms no slight evidence in favour of this practice. Dr. Lanoix informed me that, from December 1864 to January 1869, he had inoculated 2000 heifers, had resorted thrice to the original cow-pox, and had revaccinated 60,000 persons. No bad result followed any of his operations. Dr. Warlomont, of Brussels, told me that, during March, April, and May, 1869, he vaccinated 2000 children, making six punctures on each arm; in each case twelve vesicles were produced, and not the slightest accident followed the operation. The Continental animal vaccinators affirm that no untoward result has ever followed the operation in their hands. They all agree in the following conclusions, which are best given in the words of the 'Report' of the Parisian Committee, viz.:

"The transmission of cow-pox by inoculation from heifer to heifer is accomplished without difficulty.

"No animal experimented on by us has experienced any accident which may legitimately be referred to the operation.

"The successive transplantation of the lymph has not appeared to influence the character of the vesicles, seeing that those on the heifer last inoculated presented the same appearance and the same dimensions as those on the first.

"The progress of the eruption in heifers is a little more rapid than that of the vaccinal vesicle in man.

"According to our experiments syphilis is not inoculable in individuals of the bovine species.

"Whenever heifer's lymph has been used under proper circumstances as regards age, success has been almost always constant, and the results have been as good as when humanised lymph was used.

"The vesicles obtained by vaccination with heifer's lymph have, in our experience, exceeded in size those resulting from the use of humanised lymph.

"As regards the number of vesicles, both kinds of lymph have given almost identical results."¹

Opinions which have been expressed in favour of Animal Vaccination.—Various British vaccinators of extensive experience have lately testified to the advantages of animal vaccination. Dr. Ballard, at the meeting of the British Medical Association, held at Leeds in 1869, said that, "two years ago he took considerable trouble to bring this subject of animal vaccination under the notice of the pro-

¹ Op. cit.

fession of this country. He had been very well satisfied with what he had seen as to animal vaccination at Paris, and subsequently in this country. There were three points in which he thought animal vaccination had a great advantage over arm-to-arm vaccination. One thing was the purity of it, the next was the large quantity that was available, and the third was its effect in the production of very fine vesicles. He must admit the degeneration of the present vaccine virus as it had been propagated from arm to arm since Jenner's time. He considered that the characters of the vesicle had altered, that the vesicle produced now from the common vaccine, as a general rule, was not so fine nor so certain in its protection—certainly not so certain when used for revaccination—as it was many years ago, and as it was when lymph of recent propagation from the animal was employed.”¹

Dr. Druitt, at the same meeting, remarked that “he thought medical men should have the opportunity of practising animal vaccination, even on the ground that it could do no harm. In the case of a sparse population (he said), where people from their avocations sometimes, as well as their small number, were hardly able to keep up a succession of lymph by means of their children, what could be easier than to get them to arrange to bring their children three or four days in the course of a year, when a calf could be obtained, and when the practitioner and the calf, he would say, must travel together, and in one hour vaccinate the children of the whole population.”²

Mr. R. Ceely, of Aylesbury, who has examined the subject of vaccination in all its bearings more perfectly than any one living, in a letter to Dr. Blanc, says:—“I hope to be able to find a fair supply of subjects to carry on your lymph, *than which none can be better*. In my last I ought to have said that your primary lymph has all the qualities of that of the spontaneous disease, *except its too frequent acrimony*.”³

Dr. Blanc, speaking from practical experience, thus expresses his opinion:—“Animal vaccination offers the following advantages:—1st. The healthy heifer, inoculated with pure, spontaneous cow-pox, supplies a vaccine lymph free from all morbid and diathetic principles. 2nd. Spontaneous cow-pox, by being transmitted only through the bovine race, retains all its essential qualities. 3rd. Vaccination direct from the heifer offers all the characteristics of the cow-pox, as described by Jenner, Ceely, Bousquet, &c., with such modifications only as are due to the passage of the lymph through young and healthy animals. More activity, later development, and a well-marked deep cicatrix—such are the characters of the vaccina-

¹ Ballard, ‘British Medical Journal,’ Sept. 4, 1869, p. 276.

² Druitt, *ibid.*, p. 277.

³ Ceely, ‘Compulsory Vaccination by Dr. Blanc,’ p. 27.

tion due to heifer's lymph. 4th. By animal vaccination, we have always on hand an unlimited supply of good vaccine lymph. Vaccination *direct* from the heifer *is always perfectly successful*, and the results I have myself obtained are in every respect excellent. Animal vaccination will in England, as it has already elsewhere, silence all honest opposition."¹

Vaccinators on the Continent, who have tested animal vaccination, testify also in favour of this process. The 'Report' of the Committee of the Parisian Academy of Medicine says:—"What we have done proves to the Academy that, at a moderate expense, an establishment for animal vaccination could be organised and maintained, especially in the large towns. The number of punctures which can be made is illimitable, and the quantity of cow-pox which each heifer might furnish is considerable, and in each instance is more than sufficient to meet the exigencies of the most extensive practice. With heifer lymph it would be possible during an epidemic, attacking simultaneously a large number of communes more or less distant from one another, to send into the infected localities one or more inoculated heifers, which would furnish all the cow-pox necessary to make vaccinations and revaccinations on a large scale."² The extracts from this report, already quoted, testify also to the very favorable opinion of animal vaccination entertained by this committee.

In a pamphlet on this subject, published recently by Dr. Depaul, he expresses his adherence to the views mentioned in the report of the committee, and to which he has added a further experience of three years. Among other conclusions which he states in this brochure, he says, "Cow-pox practised on the bovine species, cultivated (in other words) on its native soil, preserves during numerous generations an energy and activity which are indispensable for securing its protective properties when inoculated into the human subject. Cow-pox lymph thus perpetuated is a sure means of preventing vaccinal syphilis, and of giving vaccination all the prestige it requires for rendering it truly useful."³

It is unnecessary, I think, to quote from other writers on animal vaccination—opinions which agree entirely with those we have presented, and vary only in the mode of their expression. Those interested in this question will find valuable material in the pamphlets of Dr. Warlomont of Brussels, of Dr. Fröbelius of St. Petersburg, of Dr. Pissin of Berlin, and of Dr. Lanoix of Paris.⁴

¹ Blanc., *Ibid.*, pp. 22, 23, and 27.

² 'Expériences faites à l'Académie Impériale de Médecine,' &c., p. 54.

³ Depaul, 'Sur la Vaccination Animale,' 1869, p. 96.

⁴ Warlomont, 'De la Vaccination Animale et de l'utilité des Vaccinations,' 1865.

" 'Nouvelle Communication sur la Vaccination Animale,' 1865.

" 'Discours sur la Syphilis Vaccinale et la Vaccination Animale,' 1866.

On the views expressed against the employment of humanised lymph.—The objections raised to the employment of ordinary lymph are—that it is not “pure,” that it has degenerated; and, secondly, that it has been and may be the means of conveying constitutional diseases. Many experienced vaccinators, while discarding the latter objection, have expressed in more or less positive terms their belief in the altered nature of the vaccine lymph at present in circulation.

Mr. Marson,¹ Dr. Depaul,² Dr. Ballard,³ and almost all the authors already quoted, concur in the opinion that ordinary lymph is not identical in its constitution with that derived from a case of spontaneous cow-pox, that it is altered, that it has degenerated.

If ordinary lymph were as effective as the product of natural cow-pox, and if it were equally protective, how are we to explain the fact that the vaccinia developed by it pursues a more rapid course, produces very commonly less perfect typical vesicles, presents on the eighth day more inflammatory action, leaves often very imperfect cicatrices, and is followed in not a few instances by ulceration and loss of tissue at the points of vaccination; while, on the other hand, heifer's lymph develops beautifully typical vesicles, is followed by foveated, well-marked cicatrices, and has never yet been known to be attended by any accident? The cutaneous eruptions which are met with after vaccination with ordinary lymph, the deep ulcerations, and the other “evils of vaccination” (all of which are not infrequently seen), appear to me to distinguish the *irritative* qualities of ordinary lymph from the *infective* qualities of heifer lymph. The latter is perfectly protective, and is not attended with the same untoward results.

The success of revaccination has been repeatedly produced in order to prove the deteriorated character of ordinary lymph. The superior success of revaccination with heifer's lymph over that with humanised lymph shows that the latter is not so protective as it once was, is weaker than it was, and is, in this respect also, inferior to heifer lymph.

All modern experience, I think, confirms the opinion expressed by the immortal Jenner in 1816, that vaccine lymph does not undergo deterioration by mere successive transmission (the subjects for transferring it having been properly chosen); but that it may become altered by transmission through unselected subjects. “The matter,” he said, “may undergo a change that may render it unfit for further

Fröbelius, ‘Eine geschichtliche Notiz über die Vaccination im St. Petersburger Findelhause,’ 1869.

Pissin, ‘Reform der Schutz-pocken Impfung durch die Vaccination direct von Kühen in ihrer praktischen Bedeutung,’ 1868.

Lanoix, ‘Étude sur la Vaccination Animale,’ 1866.

¹ Marson, in ‘Reynolds’ System of Medicine,’ Art. “Smallpox,” vol. i, p. 475.

² Depaul, ‘Sur la Vaccination Animale,’ p. 96, 1869.

³ Ballard, *ibid*.

use by passing even from one individual to another, and this was as likely to happen in the first year of vaccination as in the twentieth.”¹ All acknowledge that vaccination has been hitherto, to a great extent, carelessly performed in this country. In Belgium and in Russia this was observed many years ago, and the results there experienced in consequence were an increase of post-vaccinal erysipelas and the occurrence of indolent ulcers after vaccination. I have met with grey-sloughing, eroding ulcers, after apparently successful vaccination with ordinary lymph in healthy children; and, from all accounts, this sequence of vaccination appears to be on the increase. That variola attacks not infrequently young children who have been vaccinated in infancy favours the belief in the diminished efficacy of ordinary lymph.

Lastly, as regards the alleged transmission of diathetic diseases by means of vaccine lymph, I believe there is no proof of such transmission. The far-famed cases of vaccino-syphilitic inoculation, which are said to have occurred in Rivalta, Lupara, and elsewhere, do not stand the test of a searching logical or scientific investigation. The experiments which have from time to time been made to induce constitutional diseases by injecting morbid secretions into the system, render without foundation the supposition of the communication of blood diseases by vaccination. It is conceivable that vaccine lymph may become so altered by its passage through the human economy—by its forming a part of the individual’s life-current while in the system—as to be capable of producing other effects in the vaccinated than those of vaccinia alone. It seems probable that vaccine lymph, if transmitted through unhealthy or poorly nourished children, is impaired in its influence by such transmission. It is reasonable to consider such lymph to have thus been rendered irritative and liable to excite a more or less unhealthy action, though in so mild a degree as to allow the vaccinia to pursue its normal course. To say that vaccine lymph has been removed from vesicles at too late a date, and thereafter been used for vaccinating; that it has been employed on subjects in very indifferent health, and by transmission through healthy constitutions, has again been rendered “pure,”—surely this is to treat vaccinia differently from other diseases, and to throw aside the teachings of physiological science and safe logic.

In *conclusion*, it is not necessary to advocate the substitution of “animal vaccination” for “arm-to-arm” vaccination. These two modes of vaccinating are not diametrically opposed; they are complements to each other, and can in this country, as in Italy and elsewhere, be prosecuted simultaneously. It would be most advantageous to establish three or four stations throughout the United Kingdom for the prosecution of animal vaccination. Thither those might

¹ ‘Baron’s Life of Jenner,’ vol. ii, p. 398.

repair who desire to have their children vaccinated with heifer lymph, and thence heifer lymph might be procured by those who wish to use it. It would not follow that the adoption of such a plan was an acknowledgment of the deterioration of vaccine lymph by its continuous transmission through the human subject, nor would it be a recognition of the possible conveyance of diathetic disease by means of vaccine lymph ; but it would certify that, owing to the hitherto careless performance of vaccination, it is time to derive vaccine lymph once more from its original source ; it would be regarded by the public as the earnest of a desire to supply pure vaccine lymph, as the surest means of affording sufficient protection against small-pox ; and it would tend to allay fears, remove prejudices, and silence opposition. The Vaccination Act of 1867 is the most perfect legal enactment of the kind which has ever been passed by any government. When thoroughly carried out it will be followed by the best results, and it will as nearly as possible banish small-pox from amongst us. The introduction into this country of “animal vaccination” will prove a most useful adjuvant to the “arm-to-arm” process, and I am persuaded will tend in no small degree to the restoration of public confidence in Jenner’s invaluable discovery.



